The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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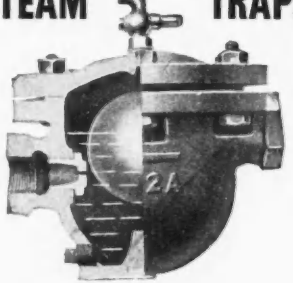

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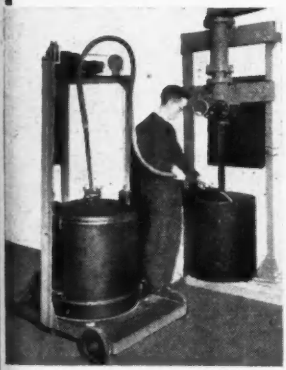

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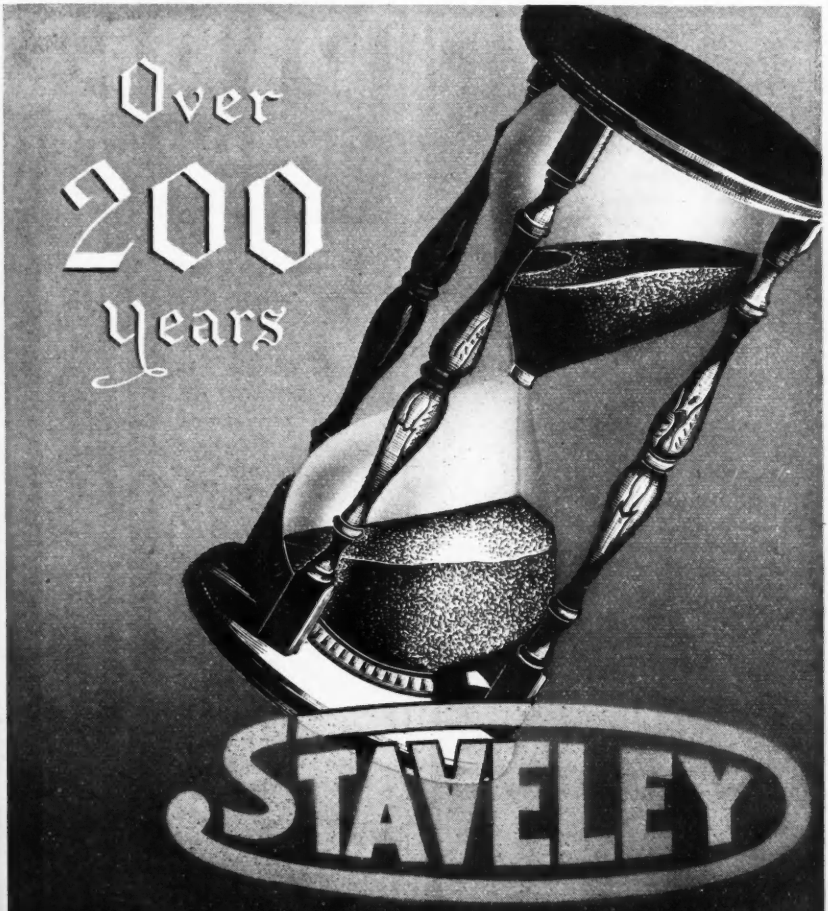

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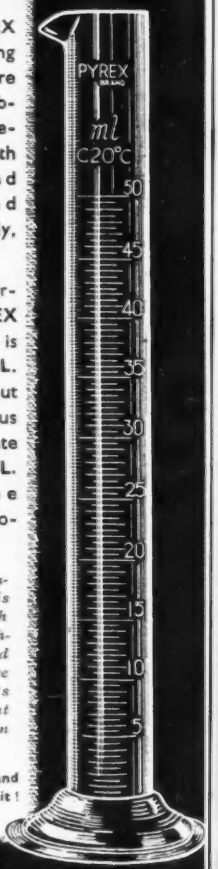

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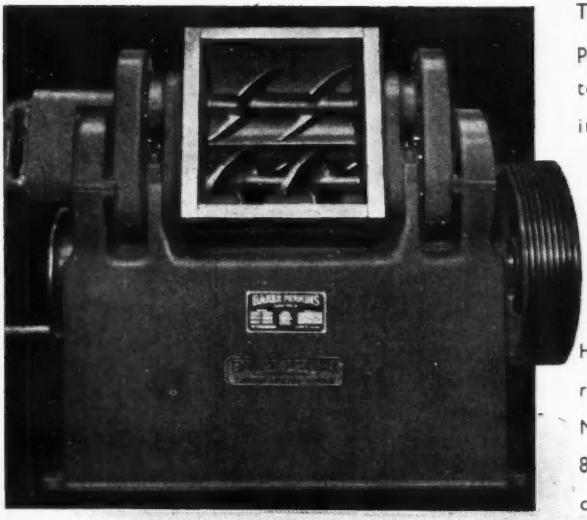

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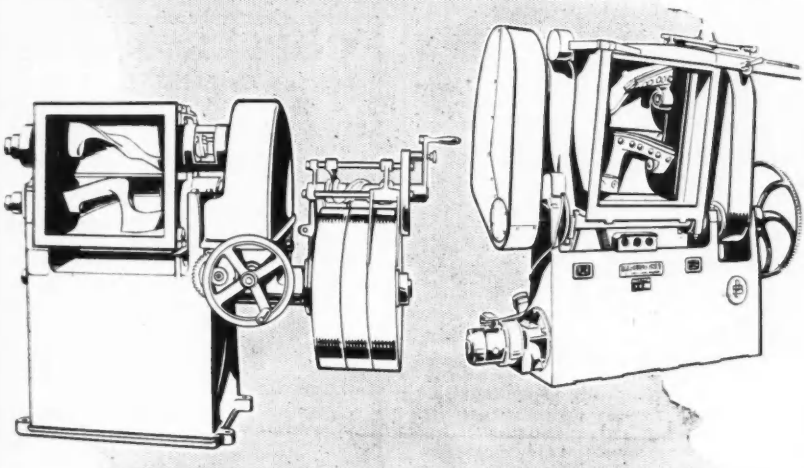

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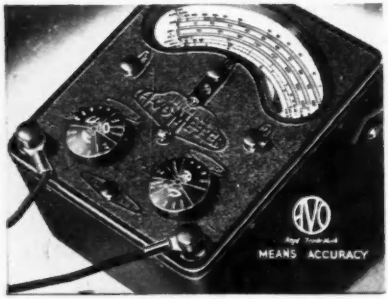

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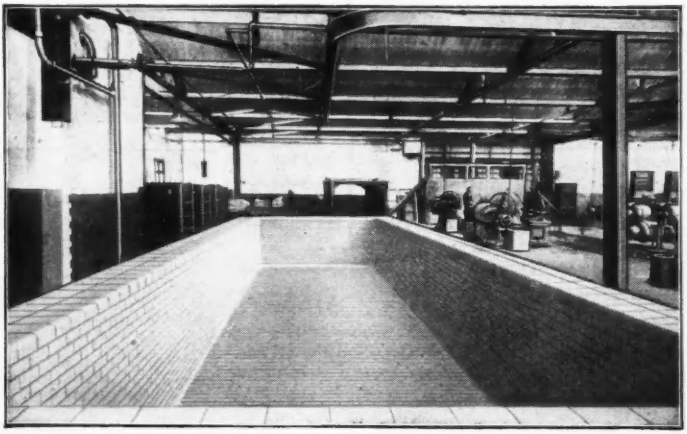

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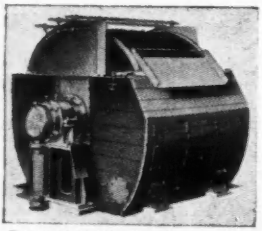

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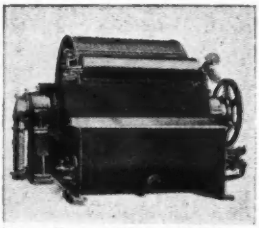

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Chemical Industry and Social Trends

THE ways of the younger generation are always strange to an older generation, and this is still true of the conduct of business to-day. The older generation has been brought up in the school of individual responsibility. It has been used to conducting its business in competition with others somewhat on the principle of the law of the jungle in which collaboration is rare and the rule is "eat or be eaten." The words of Rousseau have never been so true as they are to-day: "You reckon on the present order of society without considering that this order is subject to inscrutable changes, and that you can neither foresee nor provide against the revolution which may affect your children. The great become small, the rich poor. . . . Does fate strike so seldom that you count on immunity from her blows? The crisis is approaching, and we are on the edge of a revolution. Who can answer for your fate?"

Changes are once more upon us and they demand new technique. Why should there be collaboration in place of competition? Is it good that there should be colloboration in place of competition? The strange new world in which the Atlantic Charter foresees an era of collaboration is proving a little difficult to many of the older generation and it is not surprising that they ask these questions. One of the first things necessary to keep the business world on a steady keel after the war is to render it possible for consumers to pay for the goods they would like to purchase. It was this essential step that was lacking during the aftermath of the last war. At the end of this war the world will be impoverished and immediate means of payment would not seem to be visible. Mr. Sumner Welles has pointed out that this will mean large and long-term financing which must be arranged by the United Nations. Moreover, when payments finally come to be made they can be made only in goods and services, and those who expect to export must take the world's goods and services in payment. In this era it is obvious that the industries of each nation must be organised in such a way that arrangements can be made for this to be done. A purely isolationist policy on the part of industrialists, in which each firm decided what it would do in these major difficulties could only bring back the chaos of 1920-1930. It is clear, therefore, that industry must be organised

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on some collective basis, and there can be little doubt that the Government is working to that end.

This, however, does not complete the story. Industry has become accustomed during the last 20 years to co-operating in research into problems of interest to the whole of the industry that (wholly or partly) finances the research. One of the essentials of a research association for such a purpose is that its officers shall have access to all the information possessed by the industry. A secretive manufacturer cannot arrange to have research done purely for his own ends without letting the research staff know the real purposes of the research; on the contrary, the officers of a research association ultimately become acquainted with the innermost details of the industry they serve. With the disappearance of secrecy the way is open to collaboration. This does not mean, of course, that individual improvements cannot be made or that the individual cannot reap any benefit from improvements made by him. It is still, and always must be, open to a manufacturer to exercise his brains and those of his staff to make improvements which he can patent and utilise to his own advantage.

One advantage of collaboration, if it is conducted on sound lines, is that the consumer must ultimately benefit. Improvements in manufacturing processes or in technique will ultimately become common property, and the consumer, though expected to pay a fair price for his goods, will himself rightly expect to get the best goods for his purpose. Collaboration, however, must go beyond the intercollaboration of those in the same industry. Let us take an example from the chemical industry. It may be that a group of manufacturers will set up a research association concerned perhaps with paints, with plastics, with heavy chemicals, or in some other branch. There will arise from the operations of that body, and particularly from the information which it disseminates and by reason of the greater scientific control induced, a general raising of the standard of manufacture both in quality and efficiency. Those firms that have scientific and technical staff will take advantage of the new developments and will outstrip their older competitors who rely only on the "practical" man. In the end all firms will have to institute scientific methods and engage adequately trained technical and scientific staff.

On the other side of the fence the chemical plant manufacturers who serve these industries will also no doubt have their own methods of interchanging information and of collaborating with a view to the improvement of plant and the general conduct of their business. Up to the present it is to be feared that any collaboration that there may have been has stopped there. This state of affairs must not be allowed to continue. There are large chemical manufacturers (and no doubt some smaller ones too) who seem deliberately to reject the conception of a strong British chemical plant industry. Orders are not placed through established chemical plant manufacturers, but are placed piecemeal in ordinary engineering workshops. That is the system at its worst; at its best it seems, from the complaints that have reached us in the past, that if a piece of chemical plant is ordered from a plant manufacturer, the maker is not allowed to know its subsequent history and, once he has supplied it, it vanishes from his ken.

The advantage of a strong plant industry has been made evident by the history of many industries. We need only instance the gas and coke-oven industries. Here the plant contractor is given the task of building either the whole works or a particular piece of equipment; he is welcomed at the works at any time; he can see his plant in operation and can get any requisite information regarding its behaviour. If a plant should suffer accident or be unsatisfactory in any way the contractor is called in to put it right. Thus a great fund of information and experience has been collected for the benefit of the whole industry. Is the truth of the matter that the chemical manufacturer is still operating in the days of secrecy when he guarded his methods from all competitors?

If that is the true reason for the unsatisfactory state of affairs in the chemical industry as regards collaboration is it due to the fact that most sections of the chemical industry have no common research association and thus no driving force towards the general dissemination of information? "If we are to foresee and provide against a revolution which may affect" us all, there must be an end to the business methods of the Victorian era.

NOTES AND COMMENTS

The Chancellor on Chemical Industry

LAST Tuesday, in his review of the Government's proposed attitude towards industry after the war, the Chancellor of the Exchequer showed that he was far from ignorant of the technical developments that have been going on in the chemical and allied industries. Pointing out the necessity for regaining and retaining our technical leadership, he stressed the urgency of developing new and efficient processes. One effect of war was to release in an extraordinarily short period a high potential of invention, and behind the present scene it was possible to discern very important changes in the work on the chemistry of oil and of plastics, the increasing use of light alloys, and new processing of foodstuffs. Our industrial experience and skill would be thrown away unless turned willingly to the new products. Capital, management, and labour must be willing to look towards the new while maintaining and improving the old and substantial undertakings which had served us so well.

Getting Down to Details

THE Government, he thought, could help in three or four ways towards this end. First and above all, they could contribute by their general policy on foreign affairs, secondly, by promoting export trade, thirdly, by their policy in relation to finance and internal economic development, and finally, by their general social policy. In a general way, this is all that can be asked of a Government; when it comes to more particular support, there is usually some difficulty involved in working out the details. Here is where a strong trade or industrial organisation can come in—by indicating to Government officials exactly what action, on the lines suggested by Sir Kingsley Wood, is going to be of the greatest use to the industry concerned. When it comes to the chemical plant industry, for example, it is at once seen that a lot of spade work is necessary, as the official attitude in the past has not been specially encouraging, and even now is susceptible of further improvement. We do not propose to harp on this theme in detail now, we merely indicate once again the need for concerted action if this, or indeed any particular industry is to get its share of post-war facilities.

Post-War Trade Periods

THAT post-war trade will fall into two main sections—immediate post-war and ultimate post-war—is the opinion of Mr. E. P. Harries, organising secretary of the T.U.C., given in an address to the Institute of Export. The first period, he contends, will probably be a period of rehabilitation lasting from two to five years, according to the countries concerned. He conjectures that the European war will end before the war in the Far East, and thus extend the period of rehabilitation—a period of controlled trade and production rather than export trade as previously understood. Mr. Harries suggests the sequence in which problems would have to be dealt, such as provision of food, clothing, etc., and reconstruction of industries, and says that with this as an agreed background, the Government would require a prolongation of the control of raw materials, food and commodities, exchange and investments. It will be necessary, he thinks, to survey the present capacity of the country with a view to discussing exactly what peace-time products can be manufactured.

Changing Over

THE change-over from war-time production to civilian uses will vary according to the type of industry: some will carry straight on, but with consumption goods—textiles, chemicals, clothing, boots and shoes, and paper—it will be more difficult because of the rationing of the raw materials and the concentration of industries. He presupposes a framework of Government control, with the Government paying in many cases for the goods exported and insuring against loss in other cases. He thinks there should be ample room for private enterprise within this framework, concentrating, in the first instance, upon utility lines. As to the secondary post-war period, Mr. Harries says: "it is generally agreed that the future of world export trade depends upon raising the standard of living of all countries. If the rehabilitation period is successful, some

form of international co-ordination should remain." He believes that the need for initiative on the part of exporters will remain and that it will be essential to maintain commercial centres for use of exporters in all customer countries and more need to study individual markets. Smaller firms, unless they wish to give way to big combines, must group, and, as to monetary policy, the amount of available money should be tied to the productivity of the country concerned and not to any available amount of gold.

Penny-in-the-Slot Analysis

WE have often urged the chemist to face his responsibilities in the gas industry, responsibilities which may be expected to increase considerably in the future. Dr. E. W. Smith, Director of Gas Supply, himself a chemist, appealed to chemists, in a talk in London last week, to concentrate more on the economic side of the gas industry; to study their own costs. It was part of an argument which he built up to support the view that there must be more all-round co-operation. He spoke of the chemist who is asked to do a job without being encouraged to take an interest in the developments resulting from his work. How often, asked Dr. Smith, was the chemist asked to give advice on his findings? He was a penny-in-the-slot machine. You put a penny in and an analysis came out. He believed that, in every works, conferences of the entire staff should take place where all the facts were put on the table.

Getting Away from the Lab.

THERE is nothing revolutionary in this idea. It is so plainly sensible that one wonders, talking from outside the gas industry, why it is not done. The chemist himself cannot be entirely absolved from blame that he allows his work to remain half done. For that is what it amounts to. It is not enough to produce results in the laboratory. He should also make himself jointly responsible with others that his work is put to the best use. In another direction the chemist is getting away from the laboratory; or, rather, he is travelling around with it. Dr. Smith spoke encouragingly of the travelling laboratory van built for the Midlands. A charge per day was made to gasworks for the services of the chemists and their equipment. Dr. Smith hoped that in the next few months these would be a regular feature in the Midlands.

Molecular Distillation

SINCE our last article on this subject, in January, 1942, by Dr. D. D. Howat, further information has come to hand regarding the molecular distillation of vitamin E. Dr. K. C. D. Hickman, who is well known for his researches in this direction, has stated that the production of vitamin E is now paralleling that of vitamin A. Starting with oils of soya bean, cottonseed, and corn, American workers have produced a crude distillate which can be concentrated excellently by multiple redistillations. The final steps by which the potency is raised to 40 to 80 per cent. of mixed tocopherols are performed by Distillation Products on 14-inch stills. Research in the steroids and the oil-soluble vitamins is, at the same time, being furthered in about equal degree by the molecular still and the Tswett absorption column. Recent advances include the production of pure crystalline vitamin A and its esters, crystalline α-tocopherol acetate and γ-tocopherol palmitate, and isolation of the new provitamin A, which has been named Kitol, by Embree and Shantz.

LETTER TO THE EDITOR

"Tell the War Worker"

SIR,—Factories on war work in other parts of the country might like to consider an idea from the Midlands which received the blessing of the Minister of Production on January 29 when Mr. Lyttelton opened an exhibition in Birmingham of 400 posters and other forms of appeals to workers sent in from some 50 Midland factories. The aim of the exhibition (a private one open for one week to Safety and Welfare Officers, Works and Personnel Managers, Advertising Managers, etc.) is to pool experience of war appeals in regard to production, safety, absenteeism, welfare, economy, salvage, civil defence, national savings, and so on. It has been worth doing in the Midlands, and if other areas would like to do it, too, I feel sure my Committee would be happy to consider contributing any suggestions from our present effort.—Yours faithfully,

H. W. ELEY,
Chairman, "Tell the War Worker" Exhibition Committee.

Dunlop House,
Albany Street, N.W.1.
January 29, 1943.

The Planning of Science

Chemical Industry Discussed at London Conference

THAT science was not as fully employed in the war effort as it could be was the opinion expressed by Sir Robert Watson-Watt, C.B., F.R.S., to THE CHEMICAL AGE in discussing the open conference on "The Planning of Science," at Caxton Hall, London, on January 30-31. The conference was organised by the Association of Scientific Workers, of which Sir Robert is president. Speakers included Sir Stafford Cripps, Air Chief Marshal Sir Philip Joubert, and many leading men in chemical and other sciences. Activities of the Association have increased considerably during the present war while its membership has increased from 1200 to more than 10,000.

Mr. Dooley's Report

A report on the position in the chemical industry was given by Mr. A. Dooley, who said that in certain fields there was improved exchange of information between firms engaged on similar work. Examples in this country were firms working on medicinals, *e.g.*, bacteriostatic materials, such as penicillin. Full exchange of information on anti-malarials now took place between this country and U.S.A. There was improved linkage of technical establishments in the industry with Government and Service departments. In certain cases agreements had been made for the provision of technical facilities and liaison by specialist teams and laboratories. This means that problems were reaching the people who could solve them. Against considerable inertia, recognition was developing of the need for joint consultative committees to stimulate energy in personnel. Thus an "efficiency committee" of chemists, laboratory assistants, and management had just been formed on an elected basis in a research department at Billingham.

There was, said Mr. Dooley, a widespread feeling of detachment from the war which could be related to two factors: (a) There was a lack of real central authority and direction. Demands on the industry should be stated in a form such as: "*n* tons of substance X are wanted from you by April 1. Let us know any difficulties you can't solve locally." Instead of the present approach, whether accompanied by a tender or not, such as: "How much of X can you make and when can you start to deliver?" Real central direction should have knowledge of facilities in plant and personnel, sufficient to allocate priorities and to concentrate effort as required—that was what was meant by planning.

(b) Joint consultative committees were needed with the war effort as No. 1 on the agenda, and with the immediate job of removing the feeling of detachment from the war. He knew of laboratory assistants, deferred up to now and on important work, who felt ashamed at not being in uniform. Managements had made an attempt, but their propaganda tended to say: "You are doing good war work, boys and girls, and you can be well satisfied that you are doing your duty." We needed more of the talk which said: "This stuff is urgently wanted—let's get together and see how we can shorten our delivery date!" Managements were trying to keep the full responsibility to themselves: it must be spread over all grades of personnel including the scientific and technical staff. Could not they have an agreement between the trade unions and the Association of British Chemical Manufacturers or Imperial Chemical Industries similar to that obtaining in the engineering industry?

The Plastics Industry

Dr. H. Barron spoke of the future of the plastics industry, which, he said, looked extremely bright. One saw moulded materials everywhere replacing metals and other scarce materials. All aircraft used Perspex or cellulose acetate instead of glass. Plastic bearings were going into the heaviest engineering applications. Polyvinyl chloride and polythene were being exceptionally successful in insulation. There were, however, two vital things still lacking—raw materials and skilled technicians. The existing industry was fortunate in having many capable men of real vision.

A critical feature of the times was the problem associated with the newer types of thermoplastics which were of such obvious importance. Our showing in

the new plastics was not at all impressive. We fabricated them on an increasing scale, and skilfully, but we made comparatively little of our own plastics. So far as our home-made materials were concerned, they were all far too expensive. In war-time we could afford to pay for the special jobs these materials did, but we had to take a longer view. With regard to the American synthetic rubber activity, Dr. Barron said that it was an essential war measure in order to make good the shortage of raw rubber in the present crisis; but as a long-term project it also ensured an enormous cheap supply of by-products which could be diverted into the plastics industry, and might more than compensate for any extra cost of the rubber. As a result, added to the pressure of their already large and progressive plastics industry, there was a further thousand million dollars of Government capital to support these activities. Resulting from this was an enormous stream of fully experienced technicians.

Raw Materials for Plastics

If, therefore, in this country the feeling was that we did not want a synthetic rubber industry—in his view, wrongly—at least we should consciously go for plastics in as big a way as possible. We had two possible sources of the necessary raw materials. The obvious source was the proper exploitation of coal. The other possibility was the expansion of the oil-refining industry. The oil aspect was highly controversial, but there was complete unanimity on the coal angle. It remained only to put it into practice as soon as possible. What was being done? So far as he could see, comparatively little. The new million-pound research scheme for coal was a faltering step in the right direction. It was, however, utterly inadequate and vague. If the entire sum were devoted to the production of plastics from coal it would still be a very small investment in view of the enormous possibilities involved in the post war period.

It was necessary to get the greatest possible scientific and technical weight behind the drive for plastics. The powers-that-be must be persuaded that research and development were the best forms of investment. He suggested the inauguration of introductory courses on the subject at all universities and technical colleges. It should be made quite clear to the public, which was so attached to coal fires, that most of the raw materials for the plastics industry and most of the profits literally went up the chimney in smoke.

Points from the Speeches

Points from other speeches were :—

Sir Lawrence Bragg, F.R.S.—The war has profoundly affected all our scientists, drawing some away from their research, and forcing others to cut short their university courses. . . . Those of us who returned to universities to teach after the last war were deeply impressed by the quality of the students coming back with war experience. We shall have an extremely fine body of scientists after the war.

Mr. R. S. Bickle.—Stagnation is often held up against Civil Servants. To overcome this, scientists should be encouraged to secure the greatest contacts with similar workers in industry and universities, to take university refresher courses, and to take part in the work of the institutions; and the Government must have an enlightened policy with regard to the publication of scientific papers. The policy of grouping laboratories has been good and should be continued. The mobility of scientific staff should be encouraged.

Professor H. Levy.—We must distinguish between the science of planning and the planning of science. While the latter might interest scientific workers it may equally well lead to chaos as to progress in social life, to poverty instead of plenty.

Mr. J. G. Bennett.—Scientific research and production engineering are the two chief factors in creation of abundance. Of these two, only research can create employment. . . . Research will be the future strength of nations, as armaments and industrial resources have been in the past. We can and must gain a leading position in research if our political virtues are to make an effectual contribution to the world's future. We have no other major resource left.

Dr. D. McClean.—The Parliamentary and Scientific Committee consists of members of both Houses of Parliament and representatives of 30 affiliated bodies, all of which are directly con-

cerned in the application of science to social needs. During the last three years many important subjects have been discussed by this committee and as a result steps have been taken to secure appropriate action. In addition, through this committee, questions can be asked in Parliament, resolutions tabled with adequate support, deputations arranged to Ministers and general publicity secured.

Sir Stafford Cripps

Sir Stafford Cripps went fully into the problem of the utilisation of the scientist in the war effort, though there was, he said, no real difference in the principles that should be applied in time of war and in time of peace; we should equally desire to utilise the highest degree of scientific knowledge in our industries. The two main factors in this problem were the provision of an adequate supply of skilled scientific staff, and the proper utilisation of the scientific staff available.

"The neglect of scientific organisation," he said, "and the failure to appreciate to the full the great part that science was bound to play in a modern war, led us, in the pre-war years, to neglect the organisation of the scientific side of war. This we have attempted to remedy in the typical British way by improvising an *ad hoc* organisation to deal with the various problems as they arose. We have not created a tidy, blueprint plan of scientific organisation of the war effort, but have rather attempted to make the best use of our resources at those points where the resources seemed likely to produce the most valuable results in the quickest time. Hence our structure is one which it is easy to criticise as lacking method and orderliness, but, on the whole, it has, I believe, done as much for us as would any more tidy plan have accomplished, unless such a plan had been laid down and worked out well in advance."

Starting at the top, Sir Stafford gave a brief sketch of the organisation concerned: after the five members of the War Cabinet who are, more or less, directly concerned with scientific matters, comes the Paymaster-General, who is a pure scientist, and, in a very direct way, is able to assist and advise the Prime Minister on scientific matters. In the War Cabinet the Lord President of the Council is responsible for the Scientific Advisory Committee which has wide terms of reference upon all scientific matters; and through that committee the Cabinet is in touch with the Royal Society and with all the principal learned societies of the country. The pooling of scientific knowledge throughout the Commonwealth is assisted by the Scientific Liaison Offices of the Dominions, and valuable contacts have also been established in the United States.

Last September three distinguished scientists were attached to the Minister of Production in an advisory capacity as full-time employees of the Government. These advisers are available to assist in all the departments and can recommend measures for more effective co-ordination. They also act as a link with the British Central Scientific Office in Washington, which co-operates with the members of the Supply Missions in their joint working with American science. In addition, the Minister of Production is responsible for the Radio Board, over which Sir Stafford himself, in his personal capacity, presided, on behalf of the Minister of Production. The Minister of Labour and National Service is responsible for the Central Scientific Register and has seen to the training and mobilisation of our scientific man-power. The Minister of Home Security deals with the specialised scientific needs arising out of the problems of security against air attack. The Minister of Defence is connected with the scientific side of the defence services for which the two Secretaries of State and the First Lord of the Admiralty are responsible.

Liaison between Ministries

Next, among the various Supply Ministries and the fighting Services, is a host of liaison committees at different levels between Ministries for the exchange of scientific information and experience, but each Ministry has its own scientific organisation under a director of scientific research. There are, in addition, many scientists operating outside the research sphere, both in development and production, and on operational planning. One of the most marked developments during the war has been the growth of the application of purely scientific methods to operations, and there are now large scientific staffs in all three services devoting their skill and energy

to operational research. Among the latest developments in this direction has been the appointment of a new deputy chief of the Imperial General Staff with the responsibility for ensuring that the Army requirements—and the means of fulfilling them—are projected against the background of modern science and research.

"A great deal of our scientific strength," Sir Stafford continued, "is not in the employment of the Government at all, but in the employ of private companies. Many of the great pre-war industrial organisations already had highly skilled research laboratories, which they have extended and which are now working whole time on Government work. It is not an easy matter to co-ordinate these organisations, as there has been, in some cases, a not unnatural reluctance for industrial research departments to pool the results of their research, though in other cases this pooling has been done most willingly and to the fullest extent. All these research organisations are, in one way or another, linked up with the various Supply Ministries, though we have not yet reached a perfect method of co-ordination and there is still, I believe, room for a better integration of this section of research and development. . . . In addition to this, there are advisory committees from the industries themselves consisting of engineers or scientists to whom specific problems may be referred or from whom advice may be sought upon the way to tackle definite questions."

A Scientific War

"I think that our main difficulty with regard to the proper utilisation of the scientists in this war has been our failure to realise, at a sufficiently early stage, that this was going to be a truly scientific war and that the battle would not be won merely by the physical ascendancy of our race, but rather by the ingenuity of those who have been trained in our secondary schools, technical colleges, and universities. This realisation has gradually grown upon the country and we are now fully alive to the fact that our survival and our victory depend to a great extent upon the output of our scientists and our research institutions, and that everything must be done to utilise to the full that very high degree of scientific intelligence which this country undoubtedly possesses. We need not be too critical of the exact manner in which that scientific knowledge is made available, provided only that it *is* made available.

In conclusion, Sir Stafford declared that the scientists of this country had undoubtedly achieved the most remarkable progress during the years of the war, but everything in our power must be done to maintain the lead we had gained: he knew that, as in the past, our scientists had without stint given their services and their devotion to the country, so, too, in the future we could look to them for new implements and new devices which would make our salvation certain and would hasten our victory.

Ion-Exchange Resins

Desalting Properties

THERE is scarcely a major industry in which there are not applications for the newly-developed synthetic ion-exchange resins, according to Dr. Robert J. Myers, of the Resinous Products & Chemical Co. Laboratories, Philadelphia. Speaking before the Western New York Section of the American Chemical Society recently, Dr. Myers declared that though the ion-exchange resins have found their biggest practical use in water conditioning and softening, many special applications are now in the development stage. "Desalting" aqueous solutions of carbohydrates with an increased sucrose yield from cane and beet sugar syrup is one of the outstanding special applications of the resins. Aqueous solutions of formaldehyde, gelatin, etc., may likewise be "desalted." In these cases, dialysis is often the only alternative, and the low cost, high efficiency, and throughput of the ion-exchange resins have made them of real value.

Describing the properties of the ion-exchange resins, Dr Myers stated that experiments show that their exchange capacity depends more on chemical constitution than on mere composition. They can be used as selective adsorbents in columns where chromatographic banding occurs. Their more flexible structure means lower attrition losses. Experiments prove that there is no appreciable decrease in capacity as the number of cycles is increased. The advent of the synthetic ion-exchange resins makes it possible for the first time to remove all dissolved salts from water and other aqueous solutions by chemical reaction alone. Water so produced is comparable in quality and purity to distilled water.

Metallurgical Section

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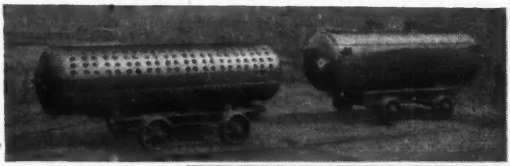

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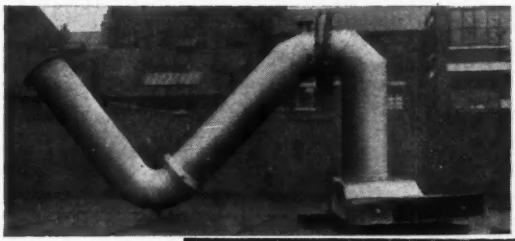

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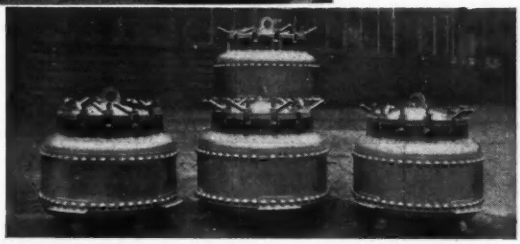

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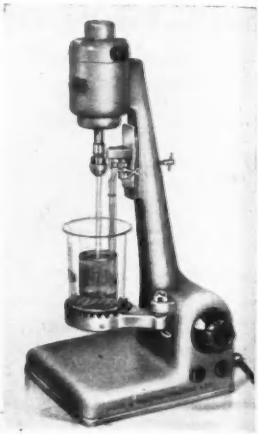

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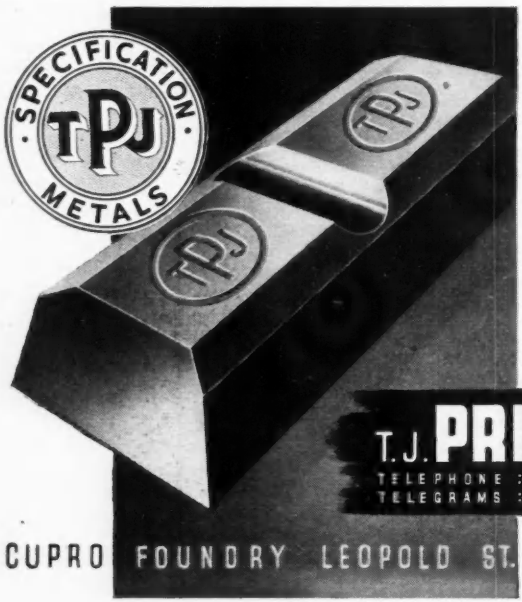

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Metallurgical Section

February 6, 1943

Germany's Search for Tinplate Substitutes

Development of Bonderised and Lacquered Cans

A REPORT* from the chemical laboratory of the Metallgesellschaft A.G., Frankfurt-am-Main appeared in *Stahl und Eisen* in August last, in which L. Schuster reviewed practical methods employed in Germany to provide a substitute for tinplate in the fabrication of food cans. Before the present war attempts were being made in Germany to find such a substitute owing to the existing and potential shortage of tin. During the last war, some experience had already been gained in the use of lacquer on black sheet, which to be efficient must resist corrosion from contact with the contents of the cans, must adhere firmly to the sheet base, and must be free from pores to give adequate protection to the underlying steel surface.

Lacquering the sheets in the rolling mills does not enable these requirements to be properly met; moreover, in transit from the mill to the fabricator the sheet is exposed to conditions liable to damage the lacquered surface. In 1937, the DZ-Blechwarenvertriebs G.m.b.H., Leipzig, and the Fritz Züchner sheet-metal works at Seesen, approached the Metallgesellschaft with the proposal to make bonderised and lacquered cans, the surface finish being applied in the sheet-metal works, thus avoiding subsequent damage to the lacquered surface.

Effect of Borderising

The bonderised coating consists of tertiary zinc phosphate with a few per cent. of secondary and tertiary ferrophosphates, producing a crystalline skin intergrown with the surface of the iron. It produces a roughening of the metallic surface. The coating is non-metallic and, according to W. Machu, contains 0.3 to 0.5 per cent. pores similar to all phosphate layers, so that unless subjected to a finishing process the coating is not corrosion-resistant. Organic materials, such as oils and lacquers, adhere very strongly to the phosphate layer, which thus offers a good base. Its non-metallic character gives a marked increase in the corrosion-resistance of the lacquered surface, thus avoiding to a large extent subcutaneous corrosion at points where the lacquered coating is damaged. At the same time it reduces the porosity of the lacquered coating.

Since bonderising not only gives a more uniform phosphate layer, but also enables coatings of different thickness and grain size to be obtained by a modification of the conditions of deposition, tests were made to determine the most suitable bonderised coating for black sheet cans. It was evident from the outset that with a single lacquer coating in comparatively thin layers such as used on food cans, a thin fine-crystalline phosphate layer would be more satisfactory than thick coatings. This was confirmed in later experiments on the effect of thin and thick coatings on the efficacy of lacquering and the effect of the bonderised layer on the physical properties of the lacquered coating. Since the phosphate layer being crystalline is less ductile than the underlying metal, careful attention must be given to the question whether the bonderised and lacquered cans possess the required mechanical properties. In the bonderising process used (No. 5), coatings of 0.003 mm. were laid down by 5 min. treatment, while No. 2 process, chosen as a basis of comparison, gave a zinc phosphate coating of 0.01 mm.

Types of Surface Tested

Cold-rolled sheets, 0.27 mm. thick with four different surfaces, were used in the tests: (a) Plain, untreated surface, (b) sanded surface, (c) bonderised surface with 0.003 mm. phosphate coating (No. 5 process), and (d) bonderised surface with 0.01 mm. phosphate coating (No. 2 process). The (b) surface was prepared with quartz sand, its roughness being almost the same as that of the No. 5 surface (c). These sheets were treated with three different lacquers of the type already extensively used for coating black sheet. The thicknesses of the coatings applied are given in Table I.

* Extracts reproduced from *The Iron and Coal Trades Review*, November 20, 1942.

TABLE I—*Thickness of Lacquered Coatings on the Four Types of Sheet Tested.*

Type of sheet.	Lacquer coating in gms. dry substance per sq. m.		
	A.	B.	C.
Bare	8.72	9.42	8.35
Sanded	9.73	9.94	8.95
Bonder 2	8.12	9.68	8.83
Bonder 5	9.54	9.45	8.72

As in use cans are subject to a certain deformation, this factor was tested by the Niesen and Röhrs method in which an a.c. voltage of 10 is applied between the lacquered sheet and an electrode in a cell with a liquid conductor, the current flow resulting from the perforation obtained being measured. As long as the lacquer skin remains whole, no current flows; the current passing increases with the number of cracks in the lacquer created by deformation. These results were plotted for the three lacquers used and some differences observed. The "deformability" of the lacquer coatings on the thin phosphate base was in one case slightly better (lacquer C), and with lacquers A and B not much worse, than with the bare surface. No. 2 phosphate layer gave a lower "deformability." In the case of the sanded sheets, cracks were observed on the lacquered surface, islands of lacquer being formed over areas of good adherence. With lacquer C no thick coating could be obtained on the sanded surface with a distribution of 8 to 10 grm./sq. mm., owing to the high porosity of the surface. These experiments seem to show that, as indicated by practical experience, satisfactory results can be achieved if the right type of lacquer is chosen.

Impact Test

In *Farben-Zeitung* (1941), H. Niesen has suggested that lacquered sheets could also be usefully submitted to an impact test in which a weighted hammer is dropped from a given height on to the sheet and the current flow measured before and after impact, as in the Niesen and Röhrs depression test. The impression obtained is comparatively sharp. It is doubtful, of course, whether this form of impact test actually reproduces conditions found in practice with filled cans, especially as the indentation is more localised in this test than when a can is subjected to a sudden blow.

Extensive tests have shown that on impact a can always dents over a much greater area than the indentation obtained in the Niesen apparatus. In spite of these limitations, the test was applied to the sheets under investigation here and it was found that No. 5 bonderised coating causes only a slight reduction in the impact strength, with No. 2 surface responsible for a much greater reduction. Lacquer B also gave a low impact strength in spite of a comparatively good Erichsen value. The sanded surface again showed that it was very difficult to obtain a continuous coating; sheets treated with lacquer C revealed a marked porosity.

Both Erichsen tests and impact tests indicated that thin bonderised coatings must be used for this type of can, thus justifying the employment of the No. 5 process. Thicker bonderised coatings are moreover impracticable as it is more difficult to cover them, so that the surface remains rough and prevents the finished cans having a good appearance.

As regards the results with the thin and thick bonderised coatings, although sheets with bonder No. 2 coating were not entirely smooth after lacquering, porosity was here again much reduced. This test is important in that it showed that with coarser phosphate layers which did not give an entirely smooth lacquering of the sheets, a reduced corrosion resistance does not necessarily follow.

Corrosion Tests

Corrosion tests of lacquered sheets on different bonderised undercoating were made with a salt spray of 3 per cent. NaCl applied for long periods. The best results were obtained with the bonderised sheets, the bare and sanded sheets exhibiting considerable corrosion. Lacquer C gave particularly bad results and tests with it were discontinued. Further tests were made with lacquers A and B and after 192 hours exposure the bonderised sheets still gave the best results, lacquer B being better than A.

As the cans after filling and sealing are subjected to a temperature of 120° in an autoclave, tests were made with cans from sheets coated with the three lacquers by exposure to 0.5 per cent. lactic acid and 3 per cent. brine, the amount of iron entering solution being determined. Again the bonderised sheets gave the best results and again marked differences were found between the three lacquers, as shown by Table II. The greater adhesion of the lacquer on the sanded surface gave good results in these boiling tests. There were little differences in the amounts of Fe dissolved with the weaker brines. The general result was that the bonderised cans were largely unaffected by treatment, the ends of the cans

TABLE II—*Solubility of Fe in Autoclave Tests. (mgm. Fe dissolved.)*

Type of Sheet	On exposure to (1) 0.5 per cent. lactic acid.			3 per cent. NaCl.		
	A.	B.	C.	A.	B.	C.
Bare	36	22	220	12	10	11
Sanded ...	25	18	220	9.3	7.6	13
Bonder 5 ...	11	14	74	7.1	6.5	8.7

(1) ½-kg. can boiled at 120° for 30 min.

from the sanded sheet showed signs of corrosion, while on the bare sheets the lacquer had begun to peel off in places.

Further autoclave tests were carried out with longer exposure of the sheets, roughly the same results as before being obtained with exposures to both lactic acid and brine. These corrosion tests indicate that the phosphate layer applied by bonderising provides a bond between the surface of the metal and the coating of lacquer, thus increasing the adhesion of the latter to the surface, and, since it is non-metallic, considerably increases the resistance to corrosion of the sub-surface. The sanded surface also provides good lacquer adhesion, but is powerless to prevent corrosion of the underlying metal.

It is evident that much importance attaches to the correct choice of the lacquer, as already indicated in "Korrosion und Metallschutz," by H. Weise. Stove-dried artificial resin lacquers are practically the only ones being used at the present time, their corrosion resistance being much greater than the types hitherto employed. The chief representatives of can lacquers now in use belong to the group of phenol and alkyd resins.

The author deals with German industrial practice in the production and utilisation of bonderised and bonderised-lacquered cans, which has made rapid strides in that country since 1937. One of the difficulties to be overcome in the adoption of this type of can was the need for suitable plant for welding the cans to take the place of the standard soldering process, as otherwise the mass production of these cans would not have been possible.

Cold-rolled strip has been found very suitable for making bonderised cans, the surface readily taking the phosphate coating. The first plant for bonderising and lacquering cans was installed at the Züchner works in 1938 by the Göhring & Hebenstreit concern of Radebeul (Dresden), bonderising and lacquering being conducted in separate units. This venture led to larger plants in which the two processes are combined. The capacity of the plant is determined by the speed of the conveyor chain carrying the cans through the various stages of cleaning, treating and fabrication, and this varies between 5000 and 6000 cans per hour.

The author refers to practical experience with bonderised cans and the future outlook. Various institutions have carried out tests with a variety of lacquers. For spinach, asparagus, and fish in oil the cans were in fact better than tinplate cans, but they were not so good with fruit.

Future development of the bonderised can reduces itself to a solution of the problem of finding the best lacquer. Should a lacquer be found capable of resisting the more acid fruits, these sheets will find more general application for the canning of fruit. Considerable progress has been made during the past few years, and modern cans are far better and more stable than those made when the process was first introduced. Züchner has suggested that the bottoms of cans could also be welded in and a fully welded can produced, thus avoiding the corrosion which occurs at the end folds, as well as giving a further saving in the amount of material used per can.

Sulphur and Phosphorus in Copper

Two Methods of Determination

by D. J. BULLIVANT

SULPHUR determination is rarely required in refined copper. For very small quantities of sulphur in copper, however, the following method is ideal. Twenty gm. of blister, unrefined, or refined copper are placed in a casserole and treated cold with 50 ml. of bromine/potassium-bromide mixture. After this has been standing at least ten minutes, 100 ml. of strong nitric acid are added. After another ten minutes the casserole is placed on the steam bath and the solution evaporated to a small volume. This is taken up with 25 ml. of concentrated hydrochloric acid and evaporated to a pasty mass. The treatment is repeated to ensure the decomposition of nitrates and to expel nitric acid. It is now taken up with 5 ml. of hydrochloric acid, diluted with water and sulphuric acid precipitated as $BaSO_4$, according to the standard procedure for sulphur. The factor for converting $BaSO_4$ to S is 0.13735. A bromine/potassium-bromide solution suitable for the determination is produced by dissolving 320 gm. of potassium bromide in just sufficient water to cause solution and mixing with 200 ml. of bromine, the latter being poured into the saturated bromide solution. After mixing well the solution is diluted to 2000 ml.

The phosphorus method is essentially for phosphor bronze, but for pure copper, a larger sample, say 10 gm., and a proportionately larger quantity of acid and of ammonium hydroxide, should be used. One gm. of the sample is dissolved in a mixture of 10 ml. water, 10 ml. concentrated hydrochloric acid, and 20 ml. concentrated nitric acid. When dissolved, the solution is re-

moved to the corner of the plate and kept hot for half an hour to get rid of the chlorine. It is then transferred to a conical flask and cooled. Ten ml. ammonium hydroxide, sp. gr. 0.88, mixed with 15 ml. water are then added and any precipitate which forms is redissolved with concentrated hydrochloric acid. The solution is then warmed to 70°C., and a mixture of 15 ml. ammonium molybdate solution and 5 ml. concentrated nitric acid added, and the solution shaken until a yellow precipitate forms. After standing in a warm place for 30 minutes the solution is filtered and the residue and original flask are washed free from mineral acid with 3 per cent. ammonium nitrate solution. The filter and residue are returned to the flask, and with the addition of 10 ml. N/10 sodium hydroxide solution, shaken until the yellow precipitate has dissolved and the excess soda back-titrated with N/10 nitric acid in the presence of phenolphthalein. One ml. N/10 NaOH equals 0.000135 gm. of phosphorus. To form an ammonium molybdate solution 150 gr. of ammonium molybdate are dissolved in water, 30 ml. concentrated ammonium hydroxide are added and made up to 1 litre with water.

Magnesium in Italy

Improved Reduction Process Outlined

MAGNESIUM production in Italy is no new development, but it is only comparatively recently that it has reached an important level, industrially speaking; what makes it the more interesting is that the process evolved in Italy for the production of magnesium from dolomite—a double carbonate of magnesium and of calcium—is of purely Italian development, and was worked out by Italian technicians. Dr. G. C. Zuccari, correspondent in Italy of the Spanish chemical journal *Ion*, has given a brief account of this process which in 1940 provided sufficient magnesium to satisfy Italy's need of the material, and which, he states, is capable of extension to meet the country's war-time requirements.

The primary raw material is dolomite, of which Italy commands unlimited quantities. This double carbonate, if pure, consists of 54.35 per cent. of calcium carbonate and 45.65 per cent. of magnesium carbonate. Calcining the dolomite, *i.e.*, converting the carbonate to oxide, is a comparatively simple process. The paucity of coal in Italy has led to the utilisation of native lignite as fuel for this purpose, with quite satisfactory results, however.

Considerable difficulties, on the other hand, are involved in the reduction of the oxide to magnesium metal, and it is in this step in the process that Italian technologists, notably Dr. Luigi Amati, have made a decided advance. Coal, the classic material for the reduction step, presents serious practical difficulties in use, since it is necessary to operate at very high temperatures in order to prevent the resultant carbon monoxide from reacting with the magnesium metal and re-forming magnesium oxide, while magnesium at 1100°C. is diffused in the gaseous state and is condensed only with difficulty. Various other reducing agents have been suggested from time to time, such as aluminium, calcium carbide, ferrosilicon, etc. The Italian process employs at this stage a mixture of magnesium oxide and ferrosilicon.

In the Italian process, dolomite quarried in the neighbourhood of the works (near Bolzano, in the Tyrol) is calcined in special furnaces fired with Italian lignits; the resultant calcium and magnesium oxides, after being crushed, are mixed with the metallic reducing agent already described, and afterwards concentrated so that they can be easily charged into steel tubes 20 cm. in diameter capable of resisting very high temperatures. These are then heated in electric muffle furnaces at 1300°C., under vacuum, the heating being maintained by hydro-electric power.

As a result of the heating and by the action of the reducing agents, the magnesium in the mixture is liberated in the gaseous state and is condensed in the form of a compact crystalline mass, which is collected by mechanical blowers under heat, a method which does not interrupt the working of the furnaces, but prevents the re-oxidation of the magnesium by the oxygen of the air. The metallic magnesium thus obtained is melted down in electric furnaces and collected in ingots. By this means a remarkably pure metal is obtained; the percentage of impurities in the crude magnesium being 0.0104, and in the ingot metal, 0.035.

Because of the exceptional purity of the magnesium thus obtained, the extra-light alloys produced from the ingot metal possess properties superior to those of similar alloys manufactured in other countries, including Germany and Japan. The Amati process, first investigated by Marcal with special reference to the siting of the plant, using dolomite as raw material and electric power for heating the reduction furnaces, has now been more widely studied in order to adapt it to raw materials and conditions different from those which led to the construction of the plant at Bolzano.

New Standards for Metals

Aluminium Alloy Bars

A NEW Standard has just been issued by the British Standards Institution in response to a request for the preparation of a specification for an aluminium alloy suitable for the manufacture of fuses and fuse parts. The type of alloy covered by the Standard is similar to that generally known as B.A. 35. The Specification gives details of the chemical composition and the mechanical tests for this alloy.

Zinc and Its Alloys

Another British Standard deals with the Sampling and Analysis of High Purity Zinc and Zinc Alloys for Die-Casting—B.S. 1005-1942. This specification was authorised by the Non-Ferrous Metallurgy Committee in 1941 in response to a request received from the Zinc Development Association. The Standard sets out the methods of sampling and analysis to be adopted for the examination of die-casting metals covered by B.S. 1003 and 1004. It should be clearly understood that these methods need not necessarily be adopted for routine control in the production of the zinc or the alloys. The procedure set out is that to be adopted in the case of dispute requiring submission to an independent authority.

Light Aluminium Alloys

A third Specification (B.S. 1094) has been issued in response to a request from the Aeronautical Research Committee. Reference is frequently made to the mechanical properties of light aluminium alloys at high temperatures, and it was therefore considered desirable that a standard should be prepared covering the essential features of the test, such as the heating period, so as to enable test figures to be correlated and compared. The standard has been based on a short-time test with a heating period of 60 minutes and gives details for carrying out tensile and hardness tests on cast and wrought light alloys at temperatures over the range 100° C to 450° C. Copies may be obtained from the B.S.I., price 1s. post free.

Women in Scrap Metal

Very few industries remain in which women are not taking an important part to relieve men for the Forces. These pictures, published by courtesy of Messrs. George Cohen Sons and Company, Ltd., and the editor of the company's magazine "600," illustrate women in the scrap metal industry. The top picture shows railings being broken up, while a mass of mixed scrap is being sorted by the women seen in the lower photograph. An interesting sidelight on this topic is derived from the report of the Turkish Production Mission's visit to Sheffield. Colonel Erdelhun, the military attaché, expressed surprise at the stamina and skill of the women employed on arduous steelmaking jobs.

Electrolytic Tinplate

Induction Heating Method in U.S.A.

WITH the aim of saving tin, high-frequency induction heating is now being employed in America to produce a smooth, shiny, corrosion-resisting finish on tinplate. This new method of fusing tin was developed by Westinghouse research and radio engineers as an answer to the problem of raising output to keep pace with the rapidly-growing requirements of the armed forces and at the same time to use a minimum of tin. It was designed as the final step in making electrolytic tinplate, a process which uses only one-third as much tin as the system of dipping steel sheets into tanks of molten metal. The need for a suitable system of tin fusing was so urgent that research work which would normally require two years was made in less than six months.

The dull, rough electrolytically tinned steel sheet is passed into the inductor heater coil where it is heated to the fusion point of the tin. As the tinplate melts, it flows into a bright shiny surface. As the dull strip moves through the coils, radio waves, 200,000 cycles per second, are passed around the metal, setting up counter currents near the surface and melting out the small irregularities. Melting action stops when the strip moves out of the coil and the metal is cooled by water.

Present electrolytic lines operate at a speed of 500 feet per minute, but it is expected they will go up to 1000 feet per minute. The induction heating method can easily keep up with that speed, whereas gas furnaces operate at only 150 feet per minute and the hot oil treatment is extremely slow—about 50 feet a minute.

The units creating the high-frequency waves are vacuum tube oscillators, essentially the same as the transmitter of a radio station. Alternating current is first converted to direct current, then fed to the oscillator tubes where it is "chopped up" into high-frequency alternating current. Glenn E. Stoltz, manager of the metal working section of the Westinghouse engineering department, conceived the idea of using radio waves to heat the tin coating to a point where it would flow evenly over the steel foundation. The actual experimental work was carried out by R. M. Baker, Westinghouse research engineer, while the necessary radio apparatus was developed by Milton P. Vore, design engineer at the company's Baltimore Radio Division.

The use of crystalline graphite in crucibles and other containers in France is restricted to metallurgical purposes. Containers with any percentage of natural crystalline graphite may be used only when authorised by the Distributor of Building Materials and Miscellaneous Products.

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Fluorspar*

Recent Production in South Africa

FLUORSPAR is a transparent or translucent glassy mineral of moderate hardness, the chemical composition of which is calcium fluoride. It crystallises in the cubic system and is usually found in well-shaped cubes. It is readily distinguishable from other glassy minerals, such as calcite, barytes and quartz, by its good octahedral cleavage, the cleavage cracks generally intersecting in equilateral triangles. The name is derived from the phenomenon of fluorescence, many green-blue specimens being green by transmitted light and blue by reflected light. The character of the light emitted depends very largely on the specimen of fluorite and to some extent on the quality of light which is incident to it. Interesting experiments have shown that the lines occurring in this fluoresecent spectrum are due to impurities in the crystal, consisting chiefly of manganese and the rare earths.

Metallurgical Uses

The chief consumer of fluorspar is the steel industry, where it is used as a flux in basic open-hearth furnaces. In the ceramic industries fluorspar is required as a constituent of enamels for metals and glazes for porcelain, and for the manufacture of opalescent glass. Considerable quantities are used for the production of hydrofluoric acid. High-grade fluorspar is used in the reduction of aluminium from bauxite and in the extraction of various rare metals from their ores. Other important applications are in refining lead and silver, and in smelting refractory ores of gold, silver and copper. Comparatively small quantities are used for a number of miscellaneous operations, including the production of the finer grades of iron castings, nickel and Monel metal; cement, ferro-alloys, carbon, electrodes, calcium carbide and cyanamide; as a paint pigment and as a binder in abrasives. The so-called "optical fluorspar" is comparatively rare and very valuable. A deposit on Oog van Malmani, near Ottoshoop, in the Western Transvaal, yielded a small quantity of pure colourless and pale blue fluorspar which was considered good enough for optical purposes, about 200 oz. of this material realising 10s. per oz. in London.

Around 1930 the commercial production of fluorspar flotation concentrates for use in the manufacture of hydrofluoric acid, glass and enamel was begun. The middling product of the flotation process, which is, however, not pure enough for the chemical and ceramic trades, is objectionable to steel makers because of the particle size, since such fine material would either blow out of the furnace or sink into the molten charge. During recent years, therefore, experiments to combat this difficulty have been carried out by several leading American concerns, and important results have been achieved. A method of sintering finely divided fluorspar was patented shortly before the war.

South Africa has been an important producer of high-grade fluorspar since 1918, when the exploitation of deposits in the Zeerust area began. Locally, the mineral is used for fluxing by steel-workers and in minor quantities for chemical and optical purposes. Before the war local consumption amounted to about 1500 tons annually. In view of the fact that the bulk of the production has had to be exported, there has hitherto been little scope for the profitable production of anything but high-grade material. The bulk of the fluorspar exported has been in the form of "acid lump," *i.e.*, fluorspar mined in lump form which has not been finely ground and mechanically treated to reach a purity of 98 per cent. CaF_2 and less than 1 per cent. SiO_2.

In recent years very little acid grade fluorspar has been available in the Union. A lower grade fluorspar is being mined, however, which is suitable for glass and metallurgical purposes. The principal market for acid grade is the United States, and before the war Japan was purchasing the lower grade in fairly large quantities. The feasibility of bringing fluorspar up to acid grade by concentration has been under investigation.

Production Figures

South African production reached its peak in 1923 and 1924, when 12,098 tons and 11,235 tons respectively were produced and exported. Thereafter the industry gradually declined until 1935, when a new rise began, and by 1938 the annual output had risen to 5221 tons, and the following year it soared to 11,378 tons, the bulk of the 1939 output being exported to Japan. The cessation of Japanese purchases, however, led to a steep drop in production, which fell in 1940 to 8180 tons. During the first six months of 1941 output declined by more than 50 per cent., and amounted to only 2024 tons.

Fluorspar deposits have been successfully exploited in various regions in the Transvaal, but production has been on a comparatively small scale, though larger bodies of the mineral, some yielding up to 50,000 tons of high grade spar, have been located. A deposit at Witkop includes a porous but coherent and often granular mass of the

* From an article in the *South African Mining and Engineering Journal*, November 28, 1942.

mineral contaminated with finely divided residual oxides of iron and manganese. Possibilities of producing a ground spar from a deposit in the Marico district are under consideration. Attempts have been made to exploit occurrences of fluorspar in South-West Africa. Material of exceptional purity has been produced in the Keetmanshoop district, but mining was suspended at the end of 1938 owing to the great distances that had to be covered; and work on an extensive deposit of low-grade fluorite in the Otjiwarongo district ceased for the same reason. Over 600 short tons were mined in the Bethani district during 1940, but after a depth of 30 feet had been reached the veins became considerably reduced, thus making the continuation of work impracticable.

Synthetic Menthol Manufacture*

Deleterious Effect of Isomers

EACH of the four isomeric forms of *p*-menthan-3-ol, *viz.*, menthol, *neo*-menthol, *iso*menthol, and *neo-iso*menthol, occurs in two optically active and one racemic modification. *d-neo*-Menthol occurs naturally in small amounts with *l*-menthol and remains in the "dementholised" peppermint oil left after crystallisation of *l*-menthol. There is no authentic evidence that any of the menthols derived from the *iso*menthones occur naturally. *dl*-Menthol can exist in two crystalline modifications with m.p. 28° and 38°C. respectively, and the form of higher m.p. may pass over to the other form, so that melting may occur at any temp. from 28° to 38°C. If *c.* 10 g. of *dl*-menthol are melted and stirred with a thermometer during cooling, the mass begins to solidify at 27°-28°C., but suddenly becomes more opaque and the temperature rises to 38°C. and remains constant until crystallisation is complete. This double setting point is very marked with pure samples and is itself a criterion of purity. *l*-Menthol also occurs in several forms, but the lower-melting forms are unstable and the m.p. of 43°C. is usually well-defined, although a setting-point curve shows two and sometimes three slight inflections under favourable conditions. The optically active and inactive forms of *neo*-menthol exhibit a great tendency to remain in the liquid state when once molten, and *d-neo*-menthol (m.p. −15°C.) is extraordinarily difficult to solidify in absence of a seeding crystal. The $[\alpha]_D$ of menthol isomers is not a reliable index of purity unless the conditions of determination are strictly defined, especially with *neo-iso*menthol and *iso*menthol, on which the solvent has an abnormal influence.

Phosphoric Acid Compounds

When any menthol is mixed with phosphoric acid, a solid addition compound is formed (Blagden and Huggett, *J. Chem. Soc.*, 1934, 317). This reaction is the basis of a reliable test for isomeric impurities in menthol. Mix 1 g. of phosphoric acid (sp. gr. 1.75) with 4.25 g. of the menthol previously dried by boiling. The mixture will have a well-defined setting-point and m.p. A setting-point of 60°C. (or m.p. 61°C.) indicates absence of isomers, and lower values indicate their presence. The test is independent of the optical activity, and when the impurity is *iso*menthol an estimate of the amount to within 1 per cent. for any mixture containing up to 40 per cent. can readily be obtained.

Taste of Isomer Solutions

The first steps in the manufacture of synthetic "menthol" lead to the formation of a mixture of isomers which is very difficult to resolve into its components, and, consequently, partly separated mixtures, of more or less constant composition, appear on the market and are used to replace natural menthol, especially in preparations for external use. A group of observers described, with moderate agreement, the tastes of solutions of the isomers in tap water (1 : 4000), as follows:—*neo*menthol, dank, earthy, fusty, mouldy, slightly bitter and, to some, slightly salt with a slight delayed cooling effect; *iso*menthol, musty, stale, mildew-like, hay- or vegetable-like, distinctly bitter and persistent without cooling effect; *neo-iso*menthol, between the other two with relatively non-persistent taste. *iso*Menthol has an over-powering effect in spoiling the taste of menthol, as little as 1 per cent., leaving an unpleasant, stale after-taste. The recent supplement to the German Pharmacopœia prescribes, as a test for absence of isomeric impurities in synthetic menthol, absence of a stale or musty taste.

The m.p. (°C.) of isomerides not given above are:—*dl-neo*-menthol, 52.0°; *d-iso*menthol, 82.5°; *dl-iso*menthol, 53.5°; *d-neo-iso*menthol, −8.0°; *dl-neo-iso*menthol, 13.5°.

* By W. E. Huggett, *Quart. J. Pharm.* (1942, *15*, 218), through *Analyst* (1943, *68*, 23).

Personal Notes

MR. V. A. M. ROBERTSON, London Transport's engineer-in-chief, has been appointed chairman of a new panel of public service vehicle operators, which will advise the Ministry of War Transport on the operation of producer-gas vehicles.

MR. DONALD CUMMING WILSON, a well-known technical chemist and director of T. and H. Smith, Ltd., Edinburgh, was admitted as a member of Edinburgh Merchant Company, at a general meeting of the company, held in the Merchants' Hall last week.

Obituary

MR. R. TAYLOR, M.A., B.Sc., a senior scientific officer of the D.S.I.R. Chemical Research Laboratory, Teddington, died on January 24.

MR. HARRISON E. HOWE, for twenty years editor of *Industrial and Engineering Chemistry*, died in America on December 10, less than a month after being awarded the Chemical Industry Medal.

MR. SAMUEL RAYNER SWALLOW died at his home at Farnley, Leeds, on January 29, aged 91. He was for over 60 years connected with the Farnley Iron and Clay Company, and in 1913 was chairman of the National Enamellers' Association.

MR. A. CLIFFORD ROBERTS, a son of the founder of J. W. Roberts, Ltd., asbestos manufacturers, which was amalgamated with Turner and Newall, Ltd., nearly twenty years ago, has died, aged 66. Mr. Roberts was a director of Turner and Newall, Ltd.

MR. A. S. HOLMES, J.P., who for 25 years has been managing director of Thomas Moscrop & Co., Ltd., oil distillers and paint and varnish manufacturers, of Bolton, died last week aged 61. He entered the firm, of which his father was the owner, at the age of 21.

DR. FRANK STURDY SINNATT, C.B., M.B.E., D.Sc., F.R.S., F.I.C., who died at Greenwich, London, S.E, on January 27, aged 62, had been director of Fuel Research at East Greenwich since 1931. His death is a great loss to the science of fuel technology, in which he was one of the world's leading authorities. Since 1902, when he was appointed lecturer in gas chemistry at the Manchester School (now College) of Technology, he had devoted his energies to fuel chemistry in its widest sense. He next became lecturer in fuels at Manchester University, and, after a period in 1915-16 in the Special Brigade, R.E., returned to begin his great work in the coal survey, which had its origin in the Research Association of the Lancashire and Cheshire Collieries, of which Sinnatt was appointed director. After the Fuel Research Board had been set up, he succeeded Professor Lander as Superintendent of the National Coal Survey in 1924, and as Director of Fuel Research in 1931. Sir Harold Hartley, in a note in *The Times*, recalls his late colleague's charming personality, and his happy relations both with his pupils and with industry. Sinnatt's name will always be associated with the coal survey, which is now almost completed, and is without parallel in any other country.

New Control Orders

Pyrethrum and Derris

The Minister of Supply has made the Control of Pyrethrum (No. 2) Order (S. R. & O. 1943, No. 126) extending control to cover stocks held by persons other than manufacturers. Application for licences to deal in such stocks should be made to the Ministry of Supply (R.M.D.) 6 Carlton House Terrace, London, S.W.1. The Order came into force on February 1.

Applications for licences under the Control of Derris (No. 1) Order, 1942, and the Control of Pyrethrum (No. 1) Order, 1942, and correspondence concerning the disposal, acquisition, treatment, use or consumption of these materials should in future be addressed to the Ministry of Supply (R.M.D.), at the above address.

Prices of Flavouring Essences

The Minister of Food has made the Flavouring Essences (Current Prices) Order, 1942 (S. R. & O. 1943, No. 143), under which the prices of flavouring essences, syrups, emulsions and concentrates may not exceed the prices which were being charged on December 1, 1942. The Order, which came into force on February 1, applies to all sales of products of the above type used for flavouring human food, including prepacked culinary essences. It does not apply to spices, mustard, substances recommended as medicines, or products of which the price is controlled by any other Order made by the Minister.

Toilet Preparations

Under the Toilet Preparations General Licence (S.R. & O. 1943, No. 116, price 1d.), issued by the Board of Trade, suppliers of controlled goods are authorised to supply anti-dermatitis preparations to certain traders, including persons concerned with the supply of gas, the production of coal, engineering, french polishing, metal plating, the manufacture of chemicals, the manufacture or use of paint (oil or cellulose), including aircraft dope, leather tanning or dyeing, rubber manufacture, the decoration of pottery, the manufacture of paper, the manufacture or use of glues (other than animal glues), the manufacture or use of cement, etc.

General News

In the January examinations eighteen candidates passed the examination in general chemistry for the Associateship of the Institute of Chemistry.

One man was killed and another seriously injured last week by a fall of superphosphate in the loading shed at Forthside Chemical Works, Bo'ness.

The Institute of Physics has made thirteen elections to the fellowship. New associates number 44; 18 subscribers and 37 students were also admitted.

A scheme for the use of 550 producer-gas buses has been adopted by London Transport, and will soon be in operation. The saving of petrol will be 3½ million gallons per annum. Each bus will burn about a ton of anthracite a week and will need refuelling every 80 miles.

Changes in the prices of oils and fats allocated to primary wholesalers and large trade users during the four weeks ending February 27, are announced as follows: castor oil firsts and seconds increased by £12 respectively, to £72 and £70 per ton naked ex works; rapeseed oil, crude, increased by £5 15s. to £54 per ton naked ex works.

Some 16 technical officers in the Southern Command are attending a special three-day "refresher" course in fuel efficiency, starting last Monday. The course is being held at the Imperial College of Science, South Kensington, and the lecturers are Mr. S. N. Duguid, of Duguids, Ltd., Lymm; and Mr. A. Milnes, of Spirax Manufacturing Co., Ltd., Cheltenham.

The scheme for better chemical control testing in gasworks, commented upon in our editorial pages this week, seems likely to be put into practice. Midland gas engineers are holding a meeting in Birmingham on February 11 to discuss proposals concerning travelling chemists with mobile laboratories. Mr. T. F. E. Rhead, chief chemist of the Birmingham Gas Department, will outline the proposals, and a full discussion is expected.

Development of the plastic and fine chemical industries is promised in the drive for new industries in Scotland, which the Scottish Council on Industry is making for post-war operation. These two industries were considered at a special meeting of the Council's executive held to report progress in Edinburgh last week. The Council is embarking on an investigation of export organisation to discover whether existing trade associations can handle the post-war position, also of port facilities and of internal and external transport arrangements.

From Week to Week

A British oil mission, headed by Mr. Geoffrey Lloyd, M.P., chairman of the British Oil Control Board, has arrived in Washington to discuss matters affecting oil and tankers. The other members of the mission are Mr. F. C. Starling, principal assistant and secretary, Petroleum Division, Ministry of Fuel and Power; Mr. T. H. Humphreys, director of Tanker Division, Ministry of War Transport; and Sir Frederick Godber, chairman of Overseas Supply Committee and member of Tanker Advisory Committee.

In future all traders wishing to sell goods by tender must apply for a licence, in accordance with the Sales by Auction and Tender (Control) Order (S.R. & O. 1943, No. 58), which comes into operation on March 15. The application should be made to the Local Price Regulation Committee except in the case of those sales by tender for which a licence is also necessary (*e.g.*, the sale of his stock by a retailer who is closing down to another retailer). In these cases application should be made to the Assistant Secretary, Industries and Manufactures Department I, Board of Trade, Millbank, S.W.1.

Three thousand tons of medical and surgical supplies and relief clothing have now been sent to Russia by the Red Cross and St. John for the sick and wounded and for civilians who have been freed from the Germans during the recent advances of the Red Army. To help defray the cost of this substantial aid to our ally one-quarter of all Red Cross Penny-a-Week Fund contributions is being handed over to Mrs. Churchill's Red Cross Aid to Russia Fund, but in order that Red Cross shall maintain its work for our own people at the highest possible level, it is essential that contributions to the Penny-a-Week Fund should be still further augmented.

Among metalliferous ores in Ireland, the mineral belt of Avoca still holds out some hope of further profitable exploitation, according to Mr. E. W. Bishopp, Director of the Geological Survey. The lead-zinc-silver deposits were not in an encouraging position, but merited further examination. As to non-metallic minerals, there appeared to be no prospect of an immediate shortage, though production from the rock phosphate deposits in County Clare still fell far short of the demand. It seemed unlikely that further minerals would be discovered in Ireland by a study of the surface, but deposits covered by bog or glacial drift might be revealed by the new geophysical methods of prospecting now in use.

Difficulties created for Eire newspapers by the cessation of imports of the special type of glue used in process engraving have just been solved by the Eire Emergency Scientific Research Bureau. When the problem was brought to the notice of the Bureau by the *Irish Times*, chemists went to work and, in a short time, succeeded in producing a completely satisfactory substitute—a refined fish glue. Consideration is now being given to the manufacture of the glue in Eire on a commercial basis.

A modified scheme for the concentration of factories engaged in provender milling and compound feeding-stuffs manufacture has been discussed by the Seed, Oil-Cake, and General Produce Association and the Ministry of Food. In this scheme the standard of efficiency maintained by a mill will be a determining factor in the decision as to whether it shall remain open. Negotiations are being concluded with regard to the formation of a company to administer the scheme.

Foreign News

Brazilian trade in iron and steel products in 1941 shows that the United States was the leading supplier.

Dry, unsatisfactory weather has reduced the cutting of wattle bark in the agricultural Kitale area of Kenya.

In Italy a number of chemical products (including turpentine spirit) to be used in the manufacture of synthetic rubber have been exempted from import duties.

No xylene may now be sold in Canada without a permit from the Chemicals Controller, according to an order by the Department of Munitions and Supply.

Copper sulphate will be produced at the works of the Rumanian State Gold Mines of Baia Mare (Munari) and handed over to the Ministry of Agriculture for distribution.

The Canadian Association of Silverware Manufacturers has appointed a committee to develop and promote plans for the use of silver as a substitute for cadmium and tin in the electroplating of war products.

The harvesting of guayule has continued in the U.S.A., and it is announced that 250,000 lb. of seed were ready at the end of 1942. Successful mechanical methods have been developed for harvesting the seed, and two new nurseries are being established in California.

Chile's two most important producers of dehydrated alcohol—which is mixed with gasoline to extend the liquid-fuel supplies—will soon expand their combined production to 1,000,000 litres per month. Recently, production of this supplementary fuel was increased from 250,000 to 500,000 litres per month.

The barium salt of nitrophthalic acid is being used in Germany as an anti-rust pigment for iron and steel. A finely ground alloy of 87 per cent. aluminium and 13 per cent. silicon is employed for priming coats.

The large methane pipe line in the Italian province of Emilia, which with its branch lines, is to be 271 kilometres (about 168 miles) in length, will soon be finished, it is stated. The pipe line will provide 40,000 cubic metres of methane gas daily.

The two largest coal-mining companies in Italy—"Carbosarda," which administers the mines in Sardinia, and "Carboarsa," which administers the mines of Arsia—have been consolidated and now bear the name "Azienda Carboni Italiana."

The shortage of chemicals in Colombia has been especially felt in formaldehyde, chrome salts, and products containing chlorine, say trade reports. Attempts have been made to supplement the shortage of imported materials by developing substitutes.

Olivine, a high content magnesia mineral found in large quantities in North Carolina, U.S.A., is being investigated as a source of magnesium. If the results are favourable large amounts of the material will be utilised.

The giant power-plant on the Saguenay River, Quebec, which will produce 1½ million h.p. of electric energy, mainly for the manufacture of aluminium, will be finished by next November, it is reported, a year in advance of schedule. Two of the twelve generating units are already in operation.

The French substitute fuel industry has been placed under the control of the new Comité d'Organisation des Carburants de Remplacement, which will be responsible for charcoal, generator briquettes, liquid substitutes, oil shale products and also petroleum derivatives (from local crude petroleum), but not for alcohol distillation.

Potassium permanganate is now being made in India from locally obtained chrome ore. Other new products include wood creosote, liquid glucose, and emetine. The manufacture of atropine sulphate is to be undertaken soon, and the output of caffeine citrate will be stepped up to meet orders placed by the Indian Stores Department.

Further information has come to hand concerning the potash industry which is to be established at Lake Champion, Western Australia. Boring has proved that the deposit contains nearly 6,000,000 tons of high grade alunite, consisting of 1,750,000 tons of potash, 3,250,000 tons of alumina, and 750,000 tons of sulphur. Research work is in progress towards the recovery of by-products, and results have been so encouraging that it appears that these may be of even greater importance than the potash itself.

Forthcoming Events

The **Institution of Chemical Engineers**, the **Chemical Engineering Group**, the Yorkshire section of the **Society of Chemical Industry**, and the Leeds area section of the **Institute of Chemistry** will hold a joint meeting in the Chemistry Lecture Theatre, Leeds University, at 6 p.m., on **February 8**, when a paper on "The Application of Crystal Analysis to Some Chemical Engineering Materials" will be read by Dr. A. H. Jay.

A joint meeting of the Plastics Group of the **Society of Chemical Industry** with the **Faraday Society** will be held on **February 9**, at 2.30 p.m., in the rooms of the Chemical Society, Burlington House, when the following papers will be read: (1) "Physical States of Rubber in Relation to its Molecular Structure," by L. R. G. Treloar; (2) "Molecular Structure and Plastic Fibre Formation," by J. R. Whinfield; (3) "Relationship Between Structure and Physical Properties of Plastics: a. "Theoretical Background," by R. F. Tuckett; b. "Experimental Background," by L. W. Turner.

A joint meeting of the **Chemical Society** with the **University College of Swansea Chemical Society** will take place at Swansea, at 3 p.m., on **February 13**, when Dr. H. J. T. Ellingham will give a lecture on "The Reducibility of Oxides and Sulphides in the Extraction of Metals."

The South Yorkshire section of the **Institute of Chemistry**, the **Iron and Steel Institute**, and local metallurgical associations will meet jointly at 2.30 p.m., on **February 13**, at the Royal Victoria Station Hotel, Sheffield, for a discussion on "The Spectrograph in Steel Works Analysis."

Chemical and Allied Stocks and Shares

ALTHOUGH there was a steady undertone in most sections of the Stock Exchange, the volume of business was somewhat lower, and movements in industrial securities were moderate in character. In accordance with the general tendency, shares of chemical and kindred companies were little changed in comparison with a week ago. Imperial Chemical eased from 38s. 9d. to 38s. 3d. and the 7 per cent. preference were 36s. 3d. The I.C.I. preliminary statement for the past year's working falls to be issued in April; the view prevails that the dividend is likely to be maintained at 8 per cent. Borax Consolidated deferred units received rather more attention and improved slightly to 35s. 3d. in response to hopes that the forthcoming dividend may be kept at 7½ per cent. Lever & Unilever at 34s. 3d. were within 3d. of the level current a week ago, while elsewhere British Aluminium were 49s. 6d., and British Oxygen slightly more active around 76s. 3d.

Dealings in B. Laporte ranged up to 78s. Fisons were better at 43s., while W. J. Bush remained very firmly held and were again quoted at 50s. "middle." The interim dividend of the last-named company is being maintained at 4 per cent.; for the whole of last year the dividend total was 10 per cent. There was a partial rally to 37s. 6d. in Wall Paper Manufacturers deferred units, while elsewhere Thomas De La Rue were around 93s. Among other shares of companies connected with plastics, Erinoid 5s. ordinary were higher at 11s. 3d., while British Industrial Plastics 2s. ordinary transferred around 5s., and Lacrinoid Products around 4s. 9d. In other directions, the units of the Distillers Co. were firm at 87s. 9d. General Refractories 10s. shares held their recent rise to 13s. 6d., there being hopes of an improved dividend for 1942 (the results are due in April), although it is realised that since 1939 profits have been dealt with conservatively and the dividend limited to 5 per cent. Firmness was shown in Turner & Newall at 77s. 9d., and in British Match at 38s. 1½d. Burt Boulton held their recent improvement, being quoted at 19s. "middle," while Cellon 5s. ordinary were again 17s. 3d., and Cooper McDougall 25s. Lawes Chemical changed hands at 9s 9d. at one time, Blythe Colour around 7s., and British Glues & Chemicals 4s. ordinary were again firm at 7s. 6d.

Iron, steel and allied shares were less active but little changed in price, Stewarts & Lloyds being 54s. 1½d., Tube Investment 93s., United Steel 26s., and Guest Keen 32s. Among textile issues a slightly easier tendency developed; Bradford Dyers were 15s. 6d., Courtaulds 49s., and British Celanese 17s. Triplex Glass eased to 32s. 9d. following their recent improvement. United Glass Bottle ordinary at 61s. 3d. maintained last week's rise. Since the war the last-named company has followed the policy of conserving resources and limiting the dividend to 12 per cent. In other directions, Gas Light & Coke ordinary had a steady appearance at close on 18s. British Tar Products transferred around 9s. 6d., British Emulsifiers 2s. shares around 3s. 3d., and Goodlass Wall at close on 13s. British Drug Houses were 22s. 6d. At 27s. 6d. British Plaster Board lost part of an earlier improvement, while Associated Cement eased to 58s. 9d. Nairn & Greenwich, however, held their recent improvement to 61s. 3d., and Barry & Staines were 39s. 4½d.

Steadiness was shown in Boots Drug 5s. ordinary at 40s., maintenance of the dividend total being generally expected; the yield is small, but this reflects the strength of the balance-sheet position, and also the assumption that, after the war, payment of

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13

an annual cash bonus may be resumed. Timothy Whites at 27s. 1½d. lost part of an earlier improvement, while Sangers were 21s. 4½d. Elsewhere, International Paint remained firm at 107s. 6d., awaiting the financial results, which may be issued in a few weeks. The encouraging trend of the war news was again reflected by higher prices for Anglo-Iranian, Burmah Oil and various other leading oil shares.

British Chemical Prices

Market Reports

CONTRACTS for most classes of heavy chemicals are being steadily drawn against by consumers, and replacement business has been on a fair scale. Fresh inquiry has been moderate and, so far as prices are concerned, the undertone of the market generally is strong. Among the soda products the demand for caustic soda and bicarbonate of soda has been well maintained with quotations on a firm basis, while chlorate of soda remains at a good level with offers not too plentiful. There has been no change in the general position of the potash compounds. The B.P. and technical grades of permanganate of potash meet with brisk inquiry and yellow prussiate of potash continues in short supply with values more or less nominal. Acid phosphate of potash is a good market. Among the miscellaneous chemicals, formaldehyde is in steady demand and barium carbonate is attracting fair attention. Glycerine prices are well held and both the pure and crude qualities meet with a brisk inquiry. White powdered arsenic is active and the market very firm. Little fresh movement has occurred in the market for coal-tar products; both the light and heavy grades of creosote oil are moving steadily into consumption, while the xylols and naphtha are steady. A good demand is reported for the benzols and toluols and a fair trade is passing in solvent and heavy naphtha.

MANCHESTER.—Chemicals for the cotton and woollen and allied trades have been in fair demand on the Manchester market during the past week, more especially in respect of deliveries under contracts, while other principal industrial consumers in the district are also specifying for satisfactory quantities in most instances. New inquiry for the general run of heavy chemicals has been on a fair scale and a reasonable proportion of this has resulted in actual fresh bookings, though near deliveries are not always obtainable. In the tar products market there has been a certain amount of new business, but the bulk of the substantial trade that is passing is against existing commitments.

GLASGOW.—Business in the Scottish heavy chemical trade has shown slight improvement during the past week in the home section. Export trade still remains rather restricted. Prices remain very firm with no actual changes to report.

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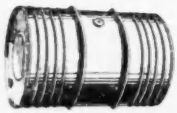

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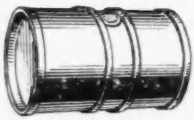

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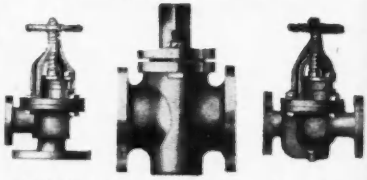

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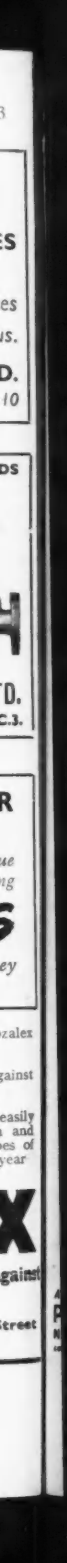

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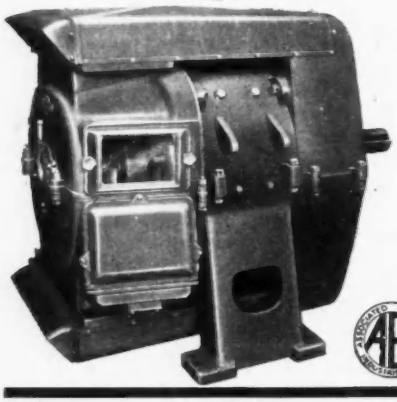

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